

Application No. 09/524,227
Docket No. 13DV-13004
Amendment dated January 16, 2004
Reply to Office Action of September 16, 2003

REMARKS

In the Office Action, the Examiner reviewed claims 1-39 of the above-identified US Patent Application, with the result that claims 21-39 were withdrawn from consideration due to a restriction requirement, the specification and claim 20 were objected to, and claims 1-20 were rejected. In response, Applicant has amended the specification and claims as set forth above. More particularly:

The specification has been amended at page 11 to make reference to reference number "4" in Figure 3, and has been amended elsewhere to correct typographical and clerical errors.

Independent claims 1 and 11 have been amended to incorporate the limitation from their respective dependent claims 9 and 18 that the bond coat (24) is a diffusion aluminide.

Independent claims 11 and 20 and dependent claim 9 (which depends from claim 1) have each been amended to specify that the surface of the aluminide bond coat (24) has surface irregularities as a result of grain boundary ridges defined by grain boundaries (34) at the surface of the bond coat (24), and that the new (equiaxed) grains (32,42,48,50) that form as a result of recrystallization of the bond coat (24) cause the surface of the bond coat (24) to be smoother and flatter as a result of eliminating at least some of the grain boundary ridges. Support for these amendments can be found in Applicant's specification in the paragraph at the top of page 5 ("In addition, the original

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surface texture of the bond coat is altered to be smoother where grain boundaries meet the bond coat surface...”), the paragraph bridging pages 9 and 10 (“the surface of the bond coat 24 is characterized by surface irregularities, termed grain boundary ridges, that correspond to the locations of the grain boundaries 34”), and the first paragraph under the heading “Trial #2” (“The reformed bond coat surfaces were much flatter than the as-deposited bond coat surfaces, which had grain boundary ridges characteristic of the deposition process (Figure 2)”).

Independent claims 1, 11 and 20 have been further amended to expressly recite that a ceramic layer is deposited on the surface of the aluminide bond coat (24) to form the thermal barrier coating (26).

Dependent claim 3 has been amended to clarify that heating of the aluminide bond coat (24) is performed during the recrystallizing step.

Dependent claims 6 and 15 have been amended to clarify that the bond coat (24) is a single-phase or two-phase aluminide prior to recrystallization, and dependent claims 8 and 17 have been amended to clarify that the bond coat (24) is a single-phase aluminide after recrystallization. Support for these amendments can be found in Applicant’s specification on page 14 (“The recrystallized bond coats were observed during examination to be single-phase as a result of the second phase having dissolved during recrystallization.”).

Dependent claim 7 has been amended to specify that precipitates (46) are

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present in the grain boundaries (34) of the grains (32) after the depositing step and before recrystallization, and claim 7 and dependent claim 16 have been amended to specify that the precipitates (46) are substantially absent from grain boundaries (44,52) of the new grains (32,42,48,50) after recrystallization. Support for these amendments can be found in Figures 2 and 6 through 9 and the associated text of the specification.

Dependent claims 10 and 18 have been amended to specify that the aluminide bond coat is a platinum aluminide.

Dependent claim 19 has been amended similarly to claim 7, but with the added limitation that the precipitates (46) are tantalum-rich precipitates (46). Support for these amendments can be found in Applicant's specification on page 14 ("Another significant observation was that all original grain boundaries 34 were decorated with tantalum-rich phases. Surprisingly, when an original grain boundary 34 was replaced by a new grain boundary 44, no tantalum-rich phases 46 (or other refractory phases) were found in the new boundary 44.")

Claim 20 has been further amended to substitute the term "equiaxed grains" for "new grains" and to substitute the term "diffusion aluminide bond coat" for "diffusion aluminide coating" in order to make consistent use of terms in the claim.

Finally, claims 21-39 have been canceled in view of the above-noted restriction requirement, for the purpose of reducing and simplifying the issues remaining in the examination of Applicant's application.

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Applicant believes that the above amendments do not present new matter. Favorable reconsideration and allowance of remaining claims 1-20 are respectfully requested in view of the above amendments and the following remarks.

Restriction Requirement

In the Office Action, the Examiner required that Applicant affirm an election under 35 USC §121 between claims 1-20 (Group I) drawn to a method and claims 21-39 (Group II) drawn to a product. During a telephone interview at the Examiner's initiation on November 27, 2001, Applicant's representative provisionally elected with traverse to prosecute Group I, claims 1-20. Applicant hereby affirms the election to prosecute claims 1-20 on the merits. As indicated above, the unelected claims of Group II have been canceled by Applicant, though Applicant respectfully asks that this action not be interpreted as concurrence with the stated grounds for restriction.

Objection to the Drawings

In the Office Action, the Examiner objected to the drawings for including in Figure 3 a reference number 4, because this reference number is not discussed in the specification. As noted above, Applicant has amended the specification to address this matter and therefore respectfully requests withdrawal of the objection.

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Objection to the Specification

The Examiner objected to the disclosure for containing informalities, including typographical errors and references to trademarks. In response, and as discussed above, Applicant has amended the specification to correct the informalities noted by the Examiner at pages 5 and 10. However, Applicant was unable to find the misspelling of the word "if" noted by the Examiner at page 7. It appears that the error may have occurred during transcription of the application from Applicant to the US Patent and Trademark Office, and as such Applicant requests that this ground for the objection be addressed by an Examiner's amendment.

Applicant believes that these amendments do not present new matter, and respectfully request withdrawal of the objections to the specification.

Objection to the Claims

The Examiner objected to claim 20 on the basis of a clerical error that Applicant has addressed by deleting the first occurrence of the word "coat" from the phrase "peening the diffusion aluminide coat bond coat....". Accordingly, Applicant respectfully requests withdrawal of the claim objection.

Rejection under 35 USC §112, Second Paragraph

The Examiner rejected claim 20 on the basis that the phrase "the new grains"

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lacked antecedent basis. As noted above, Applicant has replaced the phrase "new grains" with "equiaxed grains," which finds antecedent in the third step recited in claim 20. Consequently, Applicant believes that this ground for rejecting the claims is overcome.

Rejections under 35 USC §103

Independent claims 1, 11, and 20 and their dependent claims 2-10 and 12-19 were rejected under 35 USC §103(a) as being unpatentable over Applicant's admitted prior art (AAPA) in view of Japanese patent JP 01-180959 A to Nakamura et al. (Nakamura), either alone or in further view of one or more of U.S. Patent Nos. 4,514,469 to Loersch et al. (Loersch), 4,512,817 to Duhl et al. (Duhl), 6,042,898 to Burns et al. (Burns), and 6,365,236 to Maloney. Applicant respectfully traverses each of these rejections in view of the following comments.

Applicant's invention is directed to a process of improving the thermal fatigue life of a thermal barrier coating (26) by modifying the grain structure of an aluminide bond coat (24) on which the coating (26) is deposited. As deposited, the aluminide bond coat (24) has columnar grains (32) with grain boundaries (34) exposed at the surface of the bond coat (24). At least the surface of the bond coat (24) is then recrystallized so that new grains (42,48,50) form at the bond coat surface, replacing the original columnar grains (32), before or during deposition of the thermal barrier coating

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(26). As now recited in independent claims 11 and 20 and dependent claim 9 (which depends from claim 1), recrystallization also causes the surface of the bond coat (24) to be smoother and flatter as a result of eliminating at least some of the grain boundary ridges that were present at the bond coat surface in the as-deposited condition (compare, for example, Figures 2 and 7).

Under each of the §103 rejections, the Examiner explained that the AAPA discloses a thermal barrier coating system (20) comprising an aluminide bond coat (24) deposited on a component (10) so that the bond coat (24) is characterized by substantially columnar grains (32) and grain boundaries (34) thereof are exposed at the surface of the bond coat (24). The Examiner acknowledged that the AAPA failed to explicitly teach modifying the grain structure of the bond coat (24) by recrystallizing at least a surface region of the bond coat (24) during or prior to depositing a thermal barrier coating (26) on the surface of the bond coat (24) so that new grains (42,48,50) form at the surface of the bond coat (24), but then cited Nakamura for teaching

after depositing a diffusion coating layer of Al (i.e., an aluminide bond coat) on the surface of a gas turbine component such as a blade (i.e., a process analogous to that taught by the AAPA), the diffusion coating layer is shot-peened and then heated to a temperature at or above the recrystallization temperature of the coating layer, thereby causing recrystallized grains (i.e., "new grains") to form on the surface of the diffusion coating layer (Abstract).

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From this, the Examiner concluded that it would have been obvious to a person having ordinary skill in the art at the time the invention was made

to improve the thermal fatigue life of the TBC system of the AAPA . . . as taught by Nakamura et al., with the reasonable expectation of successfully and advantageously providing the coated superalloy component/blade of the AAPA with [benefits].

Applicant respectfully requests reconsideration of the §103 rejections in view of the following remarks.

As stated in MPEP §706, the standard of patentability was stated by the Supreme Court in *Graham v. John Deere*, 148 USPQ 459 (1966), as follows:

Under Section 103, the scope and the content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved.

The court in *In re Wright*, 6 USPQ2D 1959, 1961 (Fed. Cir. 1988), further stated that

it is the invention as a whole that must be considered in obviousness determinations. The invention as a whole embraces the structure, its properties, and the problem it solves.

The Examiner concluded that it would have been obvious to a person having ordinary skill in the art to modify the TBC system of the AAPA according to the teachings of Nakamura with a reasonable expectation of success. However, Applicant believes that, without the benefit of Applicant's teachings, one of ordinary skill in the art

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would not have any basis for a reasonable expectation that peening (and thereby smoothing) the surface of a diffusion aluminide bond coat would improve the thermal fatigue life of a thermal barrier coating deposited on the bond coat because of the express teachings of the AAPA, namely,

As noted above, TBC spallation initiates by a different mechanism on diffusion aluminide bond coats, and primarily along the alumina-bond coat interface. Accordingly, the toughness of the alumina and the alumina-bond coat interface are most important to TBC deposited on a diffusion aluminide bond coat. From this perspective, *polishing a diffusion aluminide bond coat would be expected to reduce TBC life, since sufficient surface roughness of the bond coat would be desired to promote adhesion of the alumina to the bond coat, and to inhibit crack propagation through the alumina and alumina-bond coat interface. As a result, conventional practice has been to grit blast the surface of a diffusion aluminide bond coat to increase its roughness to about 50 microinches (about 1.25 micrometers) Ra or more before depositing the TBC. (Emphasis added.)*

Nothing in Nakamura refutes that this is the conventional wisdom in the art of TBC systems, which are distinguishable from the corrosion-resistant coating (referred to as an “environmental coating” in Applicant’s specification) taught by Nakamura and which, to Applicant’s knowledge, is not disclosed as being used as a bond coat to adhere a ceramic coating. As such, while Nakamura teaches that there are advantages to peening and recrystallizing a diffusion coating used as a corrosion-resistant outer coating, Nakamura does not teach or suggest that such a recrystallized coating would be

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acceptable for use as a bond coat for a TBC.

In view of the above, the AAPA and Nakamura are not properly combinable as prior art references under 35 USC §103 because the AAPA teaches away from any treatment that would result in smoothing and flattening a diffusion aluminide bond coat, while Nakamura teaches peening a diffusion aluminide coating to form “fine recrystallized grains” that are likely to cause smoothing and flattening of Nakamura’s coating. Therefore, the Examiner’s argument that a person of ordinary skill would be motivated to modify the AAPA on the basis of Nakamura’s teachings is contrary to the teachings of the AAPA. As such, a §103 rejection based on the combination of the AAPA and Nakamura is improper because a person of ordinary skill would not be motivated to combine the teachings of the prior art without relying on Applicant’s teachings. *In re Lintner*, 173 USPQ 560, 562 (CCPA 1972); *In re Regel*, 188 USPQ 136 (CCPA 1972); *In re Jansson*, 203 USPQ 976 (CCPA 1979). “The [references] disclose, at most, that one skilled in the art might find it obvious to try the claimed invention. But whether a particular combination might be ‘obvious to try’ is not a legitimate test of patentability.” See MPEP §2145X.B., citing *In re Fine*, 5 USPQ2D 1596, 1599 (Fed. Cir. 1988), citing *In re Geiger*, 2 USPQ2D 1276, 1278 (Fed. Cir. 1987).

In view of the above, Applicant believes that the combination of the AAPA and Nakamura does not fulfil the requirements set forth in *Graham v. John Deere*, and

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therefore respectfully requests withdrawal of the first rejection to the claims under 35 USC §103(a).

From the above, it is also apparent that Loersch, Duhl, Burns and Maloney cannot be said to supplement the teachings of the AAPA and Nakamura in order to arrive at Applicant's invention, as none of these additional references provide motivation for recrystallizing, smoothing and flattening a diffusion aluminide bond coat used to adhere a ceramic thermal barrier coating. Therefore, Applicant respectfully requests withdrawal of the remaining rejections to the claims under 35 USC §103(a).

Double Patenting Rejections

The Examiner rejected claims 1-20 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over claims 1-22 of U.S. Patent No. 6,565,672 to Spitsberg et al. in view of the AAPA, and provisionally rejected claims 1-20 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over claims 1-26 of U.S. Patent Application Serial No. 09/944,705 to Spitsberg et al. (published as US 2003/0041926 A1) in view of the AAPA. Applicant hereby acknowledges that the present application and each of these references (the "Spitsberg references") are commonly assigned.

In characterizing each of the rejections, the Examiner stated that it would have been obvious to deposit the aluminide coatings recited in the claims of the

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Spitsberg references using the diffusion deposition techniques disclosed by the AAPA in order to arrive at Applicant's claimed invention. However, Applicant's application was filed before each of the Spitsberg references (March 13, 2000, compared to August 31, 2001, for both Spitsberg references). Through no fault of Applicant, the later-filed Spitsberg patent was issued and the later-filed Spitsberg publication was published prior to the examination of Applicant's application. Instead, the prior issuance and publication of the Spitsberg references appear to be attributable solely to "administrative delay" (see *In re Braat*, 937 F.2d 589, 19 USPQ2D 1289 (Fed. Cir. 1991); *In re Goodman*, 29 USPQ2D 2010 (Fed. Cir. 1993)), necessitating a two-way obviousness determination (see MPEP §804 II.B.1.b.).

According to this two-way obviousness analysis, if Applicant's claims can be shown to be patentably distinct from those of the Spitsberg references or if the claims of the Spitsberg references can be shown to be patentably distinct from Applicant's claims, then issuance of a patent covering Applicant's claims would not result in an unjustified timewise extension of the right to exclude - the public policy that serves as the basis for judicially-created doctrine of obviousness-type double patenting rejections. See MPEP §804.

In setting forth the double-patenting rejections, the Examiner did not apply a two-way obviousness analysis, but merely argued that Applicants claims are obvious over the claims of the Spitsberg references (i.e., the Examiner used the one-way

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obviousness analysis discussed at MPEP §804, Section II.B.1.(a)). The claims of the Spitsberg patent require a “controllably oxidizing” step not taught or suggested by Applicant’s claims, and the claims of the Spitsberg publication require a specified “average sulfur content” that is not taught or suggested by Applicant’s claims. Therefore, the claims of the Spitsberg references are not obvious in view of Applicant’s claims, and the required two-way obviousness determination has not been satisfied.

In view of the above, Applicant requests withdrawal of the judicially-created double patenting rejections of Applicants’ claims over the Spitsberg references.


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Closing

In view of the above, Applicant believes that all issues outstanding from the Office Action have been addressed, and that the claims define patentable novelty over all the references, alone or in combination, of record. It is therefore respectfully requested that this patent application be given favorable reconsideration.

Should the Examiner have any questions with respect to any matter now of record, Applicant's representative may be reached at (219) 462-4999.

Respectfully submitted,

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